AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1.   (currently amended) A method for routing data packets at NAT routers between a public network and a device in a private network via at least one intermediate private network, comprising:

receiving a data packet at a network routing device that is a NAT router residing in the public network and in communication with a first one of the at least one intermediate private network, the data packet being formulated in accordance with the Internet Protocol (IP) to have a packet header including a destination IP address field, a source IP address field, and an options field having a stack of two or more private IP addresses appended to each other in a predefined order and defining a path to the device;

extracting, at the NAT router, a private IP address directly from the options field;

directly formatting, at the NAT router, the destination IP address field of the packet header with the extracted private IP address prior to forwarding the data packet;

reformatting, at the NAT router, the options field to remove the extracted private IP address from the stack prior to forwarding the data packet; and

repeating the process of extracting, formatting, and reformatting at each network routing device, including additional NAT routers, residing between each of the at least one intermediate private network and the private network.

2.   (cancelled)

3.   (original) The method of Claim 1 further comprises forwarding the data packet through a private-side interface of the network routing device.

4.   (cancelled)

5.   (original) The method of Claim 1 further comprises formatting the destination IP address field when an IP address residing in the destination IP address of the packet header matches a public-side interface IP address for the network routing device.

6-8.   (cancelled)

9.   (previously presented) A network routing device that translates addresses between an intermediate private network and a public network, the network routing device adapted to receive data packets at a public-side interface, the data packets being formulated in accordance with Internet Protocol (IP) to have a packet header including a destination IP address field, a source IP address field, and an options field having a stack of two or more private IP addresses appended to each other in a predefined order and defining a path to a device residing in a private network, the network routing device being operable to extract a private IP destination address from the options field, format directly the destination IP address field of the packet header with the extracted private IP address, and reformat the options field to remove the extracted private IP address from the stack prior to forwarding the data packets through the intermediate private network to a second network routing device that translates addresses between the intermediate private network and the private network.

10.   (previously presented) The network routing device of Claim 9 being further operable to format the destination IP address field when an IP address residing in the destination IP address field of the packet header matches a public-side interface IP address for the network routing device.

11-12. (cancelled)

13. (currently amended) A method for routing data packets <u>at a NAT router</u> between a public network and an originating network device in a private network via at least one intermediate private network, comprising:

receiving a data packet transmitted by the originating network device at a network routing device <u>that is a first NAT router</u> residing between the private network and a first one of the at least one intermediate private network, the data packet being formulated in accordance with the Internet Protocol (IP) to have a packet header including a destination IP address field, a source IP address field, and an options field, .and having an original source private IP address in the source IP address field of the packet header and a destination IP address in the destination IP address field of the packet header;

directly formatting<u>, at the first NAT router,</u> the options field of the packet header with the original source private IP address;

directly formatting<u>, at the first NAT router,</u> the source IP address field of the packet header with an IP address for the network routing device prior to forwarding the data packet;

forwarding the data packet to a second network routing device<u> that is a second NAT router</u> residing between the first one of the at least one intermediate private network and the public network;

appending<u>, at the second NAT router,</u> the IP address for the network routing device <u>that is the first NAT router</u> to the original source private IP address in the options field of the packet header to form a source stack which defines a path to the originating network device; and

formatting, at the second NAT router, the source IP address field of the packet header with a public interface IP address for the second network routing device that is the second NAT router prior to forwarding the data packet.

14-17. (cancelled)

18.   (previously presented) The method of Claim 13 further comprises receiving the data packet at a destination network device having an IP address that matches the destination IP address embedded in the destination IP address field; and extracting the original source private IP address and the IP address for the network routing device from the options field and the IP address for the second network routing device from the source IP address field of the packet header for subsequent communications with the originating network device.

19-23. (cancelled)

24.   (currently amended) A traversable addressing scheme for packets formulated in accordance with the Internet Protocol (IP) to have a packet header including a destination IP address field, a source IP address field, and an options field, comprising:

a source address field in the options field of the packet header having a stack of two or more private IP addresses concatenated to each other in a predefined order and defining a path to a source device residing in a first private network; and

a destination address field in the options field of the packet header having a stack of two or more private IP addresses concatenated to each other in a predefined order and defining a path to a destination device residing in a second private network, wherein:

(a) the first private network is connected to a public network via a first intermediate private network and the second private network is connected to the public network via a second intermediate private network;

(b) the first private network is connected to the first intermediate private network by a first network address translation (NAT) router, the first intermediate private network is connected to the public network by a second NAT router, the second private network is connected to the second intermediate private network by a third NAT router, the second intermediate private network is connected to the public network by a fourth NAT router; and

(c) each of the NAT routers is operatively connected to: (i) receive a data packet having a packet header including a destination IP address field, a source IP address field, and an options field having a stack of two or more private IP addresses appended to each other in a predefined order and defining a path to the device; (ii) extract a private IP address directly from the options field; (iii) directly format the destination IP address field of the packet header with the extracted private IP address prior to forwarding the data packet; and (iv) reformat the options field to remove the extracted private IP address from the stack prior to forwarding the data packet.

25-30. (cancelled)

31.   (currently amended) A method comprising:

receiving, at a NAT router a packet at a first interface of an address-translating routing device that is the NAT router situated between a public network and an intermediate private network, said packet having a header including a destination address field, a source address field, and an options field;

selectively reading, at the NAT router, a first destination address from a plurality of destination addresses within said options field, where the plurality of destination addresses define a path to a network device residing in a private network;

selectively placing, at the NAT router, said first destination address into said destination address field;

reformatting, at the NAT router, the options field to remove the first destination address from the plurality of destination addresses;

forwarding, at the NAT router, said packet out a second interface; and

repeating said reading, said placing, said reformatting, and said forwarding [[for]]at each address-translating routing device that are additional NAT routers situated between the intermediate private network and the private network.

32.   (previously presented) The method of Claim 31 further comprising checking an indicator within said options field, wherein said selectively reading and said selectively placing are performed when said indicator is in a first state.

33.   (previously presented) The method of Claim 32 further comprising setting said indicator to a second state when no destination addresses remain in said options field.

34.   (cancelled)

35.   (previously presented) The method of Claim 32 further comprising updating said indicator, wherein said indicator indicates how many destination addresses remain in said options field.

36.   (previously presented) The method of Claim 31 further comprising removing said first destination address from said options field before performing said forwarding.

37- 38.   (cancelled)

39.   (previously presented) The method of Claim 31 wherein said first interface is a public interface and said second interface is a private interface.

40.   (previously presented) The method of Claim 31 wherein said header is an Internet Protocol header.

41.   (currently amended) A method for routing data packets in a packet-switched network, comprising:

receiving, at a NAT router, a packet at a first interface of an address-translating routing device that is the NAT router situated between a private network and an intermediate private network, said packet having a header including a destination address field, a source address field, and an options field having a source address field and a destination address field;

reading, at the NAT router, a first source address from said source address field of the packet header;

inserting, at the NAT router, said first source address into said source address field of said options field;

placing, at the NAT router, a public address of the address-translating routing device into said source address field of the packet header;

forwarding, at the NAT router, said packet out a second interface of the address-translating routing device to a destination device via the intermediate private network and a public network;

reading, at the destination device the first source address from the source address field of the options field; and

formatting, at the destination device an outgoing data packet from the destination device with the first source address in the destination address field of the options field.

42.   (cancelled)

43.   (previously presented) The method of Claim 41 wherein said header also includes a header length field, and further comprising updating a number stored in said header length field to reflect a presence of said first source address.

44-45. (cancelled)

46.   (previously presented) The method of Claim 41 wherein said first interface is a private interface and said second interface is a public interface.

47.   (previously presented) The method of Claim 41 wherein said header is an Internet Protocol header.

48.   (currently amended) A method for traversing multiple address-translating intermediate routing devices that are NAT routers between a host in a private network and a public network, comprising:

receiving, at a NAT router, a packet having a packet header at a first one of the intermediate routing devices that is the NAT router, wherein the first one of the intermediate routing devices is situated between the private network and an intermediate private network;

storing, at the NAT router, contents of a source address field of the packet ·header into an options field of the packet header;

replacing, at the NAT router, contents of the source address field with an address of the first one of the intermediate routing devices; and

performing the receiving, storing, and replacing for each one of the intermediate routing devices that are additional NAT routers.

49.   (currently amended) A method for traversing multiple address-translating intermediate routing devices that are NAT routers between a public network and a host in a private network, comprising:

receiving at a NAT router a packet having a packet header at a first one of the intermediate routing devices that is the NAT router, wherein the first one of the intermediate routing devices is situated between the public network and an intermediate private network;

replacing, at the NAT router, contents of a destination address field of the packet with a destination address from the options field of the packet header; and

repeating the receiving and replacing for remaining ones of the intermediate routing devices that are additional NAT routers, wherein the intermediate routing devices interconnect the public network, the private network, and at least one intermediate private network including the intermediate private network.

50.   (previously presented) The method of Claim 48 wherein a second one of the intermediate routing devices is situated between the intermediate private network and the public network.

51.   (previously presented) The traversable addressing scheme of Claim 24 comprising a repository that stores a plurality of traversable network addresses, each uniquely identifying a respective node in a private network that is separated from the public network by at least one intermediate private network, and each traversable network address being composed of a concatenation of a private IP address of the respective private network node and public IP addresses of each network address translation (NAT) router interconnecting the respective private network node, the at least one intermediate private network, and the public network.

52.   (previously presented) The traversable addressing scheme of Claim 51 wherein IP addresses within each traversable network address are concatenated in an order that devices corresponding to the IP addresses are encountered during traversal of a packet from the public network to the respective private network node, and wherein the IP addresses are stored in one of forward and reverse versions of the order.

53.   (cancelled)